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13. ABSTRACT *(Maximum 200 words)*

THE PURPOSES OF THIS SURVEY WERE TO EVALUATE, IDENTIFY PROBLEMS WITH, AND MAKE RECOMMENDATIONS TO IMPROVE:

1. DOMESTIC AND INDUSTRIAL WASTEWATER COLLECTION
2. TREATMENT AND DISPOSAL SYSTEMS
3. SURFACE AND STORM WATER DRAINAGE SYSTEMS
4. WASTEWATER LABORATORY FACILITIES
5. OIL AND HAZARDOUS SUBSTANCES SPILL CONTROL AND CONTINGENCY PLANS.

MAJOR RECOMMENDATIONS INCLUDE:

1. RENOVATING THE IMHOFF TANK AND IMPLEMENTING PROPER OPERATING PROCEDURES
2. DETERMINING IF THE SEWAGE TREATMENT LAGOON IS A SOURCE OF DBCP CONTAMINATION
3. REVISING THE SPILL PREVENTION, CONTROL, AND COUNTERMEASURES PLAN (SPCCP)
4. REVISING THE INSTALLATION SPILL CONTINGENCY PLAN (ISCP).

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ABERDEEN PROVING GROUND, MD 21010

WASTEWATER ENGINEERING SURVEY NO. 32-66-0108-84
ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO
15-29 FEBRUARY 1984

AEHA

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DEPARTMENT OF THE ARMY
US ARMY ENVIRONMENTAL HYGIENE AGENCY
REGIONAL DIVISION -- WEST
FITZSIMONS ARMY MEDICAL CENTER
AURORA, COLORADO 80045

CPT LaDuc/jig/AUTOVON
943-8881

REPLY TO
ATTENTION OF
HSHB-MW-E

26 APR 1984

SUBJECT: Wastewater Engineering Survey No. 32-66-0108-84, Rocky Mountain Arsenal, Commerce City, Colorado, 15-29 February 1984

Commander
US Army Materiel Development and
Readiness Command
ATTN: DRCSG
5001 Eisenhower Avenue
Alexandria, Virginia 22333

1. Twenty copies of subject report with Executive Summary are inclosed.

2. Additional copies of this report are inclosed for mailing to HQDA (DAEN-ZCF-U), HQDA (DAEN-ZCE), and Commandant, Academy of Health Sciences (HSHA-IPM).

FOR THE COMMANDER:

1 Incl
as

Joseph E. Farlow

JOSEPH E. FARLOW, Ph.D., R.P.E.
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REGIONAL DIVISION -- WEST
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REPLY TO
ATTENTION OF

HSHB-MW-E

EXECUTIVE SUMMARY
WASTEWATER ENGINEERING SURVEY NO. 32-66-0108-84
ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO
15-29 FEBRUARY 1984

1. Purpose. The purpose of this survey was to evaluate, identify problems with, and make recommendations to improve domestic and industrial wastewater collection, treatment and disposal systems; surface and stormwater drainage systems; wastewater laboratory facilities; and oil and hazardous substances spill control and contingency plans.

2. Essential Findings.

a. The Imhoff Tank at the domestic wastewater treatment plant (WWTP) was improperly operated and maintained, and was in need of major renovation.

b. The lagoon at the WWTP was a source of potential dibromochloropropane (DBCP) contamination of groundwater.

c. The Spill Prevention, Control, and Countermeasures Plan (SPCCP) and the Installation Spill Contingency Plan (ISCP) were inaccurate and incomplete.

3. Major Recommendations.

a. Renovate the Imhoff Tank and implement proper operating procedures.

b. Determine if the lagoon is a source of groundwater DBCP contamination.

c. Revise the SPCCP and the ISCP.

HSHB-MW-E
SUBJECT: Wastewater Engineering Survey No. 32-66-0108-84, Rocky Mountain Arsenal, Commerce City, Colorado, 15-29 February 1984

CONTENTS

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WASTEWATER ENGINEERING SURVEY NO. 32-66-0108-84
ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO
15-29 FEBRUARY 1984

I. AUTHORITY. Letter, HSHB-E/WP, this Agency, 16 August 1983, subject: USAEHA Mission Services, FY 84, with 1st Indorsement, DRCSG-S, HQ, DARCOM, 22 October 1983.

II. REFERENCES. A list of references is provided at Appendix A.

III. PURPOSE. The purpose of this survey was to evaluate, identify problems with, and recommend actions to improve domestic and industrial wastewater collection, treatment, and disposal systems; surface and stormwater drainage systems; wastewater laboratory facilities; and oil and hazardous substances spill control and contingency plans.

IV. GENERAL.

A. Personnel Contacted. Appendix B contains a list of personnel contacted during the survey. Entrance and exit briefings were attended by installation personnel as indicated.

B. Survey Personnel. This survey was conducted by CPT Michael F. LaDuc, Sanitary Engineer, Environmental Health Engineering Branch, this Division.

C. Background.

1. Location. Rocky Mountain Arsenal (RMA) is located in Adams County, 10 miles northeast of the center of Denver, Colorado. Appendix C contains a general site map.

2. Mission. At the time of this survey, the installation was largely inactive. The four-fold mission was to provide support to AMCCOM installations, DOD Agencies, and other agencies; to provide facilities for demilitarization of assigned material; to execute approved installation restoration programs and projects; and to maintain Rocky Mountain Arsenal facilities, equipment and resources as may be described by mobilization schedules.

3. Population. The resident population of RMA was 3, and the nonresident population was approximately 400. The effective population, based on the resident population plus one-third of the nonresident population was 136.

4. Regulatory Authority. The State of Colorado did not have primacy over federal installations for wastewater disposal regulation. The primary regulatory agency was the US Environmental Protection Agency (EPA). The policy of EPA, Region VIII, which includes Colorado, was to enforce compliance with state regulations.

V. FINDINGS AND DISCUSSION.

A. General.

1. Detailed topographical, climatic, and population information is on file at this Division and at the Water Quality Engineering Division of this Agency.

2. Wastewater systems at RMA consisted of a domestic wastewater collection, treatment and disposal system, several septic tank systems, and an industrial wastewater collection and treatment system which discharged to the sanitary sewer. There were two point-source wastewater discharges to surface waters; the domestic wastewater treatment plant (WWTP), and a discharge of air compressor cooling water, both regulated by National Pollutant Discharge Elimination System (NPDES) Permit Number CO-0021202.

3. The principal types of wastewater at RMA were domestic, laboratory, vehicle washing and maintenance, air compressor cooling, boiler blowdown, laundry, and swimming pool filter backwash.

B. Domestic Wastewater.

1. General. The domestic wastewater collection and treatment system was constructed in 1942. The WWTP had undergone several modifications. Unit operations consisted of a bar screen, an Imhoff Tank, multi-media filtration, carbon adsorption, and chlorination. The NPDES Permit effluent limitations and monitoring requirements are provided in Appendix D.

2. Collection.

a. Sewer Construction. The collection system consisted of 6- to 18-inch diameter, vitrified-clay tile, gravity-flow mains and 6- to 8-inch diameter steel forced mains. The system was originally designed for a flow capacity of 1.4 million gallons per day (MGD). Flow averaged 33,000 gallons per day (gpd) for the 6-month period preceding the survey.

b. Sewer Condition.

(1) RMA utilities personnel reported that there was an infiltration/-inflow problem with the system. The extent of the problem was not known since an infiltration/inflow analysis had not been performed. Comparison of the average flow recorded at the WWTP (33,000 gpd) to the effective population (136), showed an average daily per capita usage of 243 gallons which was more than twice the normally expected 100 gallons per capita per day (gpcd). This quantity of infiltration did not overload the collection or treatment systems; however, the infiltrating groundwater was reportedly contaminated with dibromochloropropane (DBCP), a pesticide commercially marketed as Nemagon®. Because DBCP was a suspected carcinogen and sterilant, its presence required the addition of advanced treatment processes to the WWTP. This situation will be discussed further in the domestic wastewater treatment section of this report.

(2) The wastewater flow in the collection system was far below design values, which resulted in low velocities and subsequent deposition problems. The greatest deposition occurred at manholes. Personnel occasionally flushed these facilities to remove the deposited material.

c. <u>Lift Stations</u>.

(1) There were 5 lift stations in the domestic wastewater collection system. No information was available on the pumping capacities of any of them. Since the pumps were sized for the design capacity of the system, they operated far below their capacities, and maximum pumping rates were not required. None of the lift stations had emergency power sources, as required by para 13, TM 5-814-3. Because of the largely inactive status of the installation and the extremely low wastewater loadings, the lack of emergency power was not a critical problem. A power loss at the lift stations would have been little more than an inconvenience. The storage capacity in the sewer lines and lift station wet wells would have reduced the impact of a power outage. All lift stations were checked daily by the WWTP operator, and were adequately maintained.

(2) The main lift station was at Building SS-392. It consisted of two air-operated ejectors, two air compressors, and a compressed air storage tank, and was located in an underground vault. Access to the vault was via a roof hatch and ladder.

(3) The lift station at Building SS-393 was similar to the one at Building SS-392, except that it had only one ejector and one air compressor. The lift station at Building 341-VB consisted of a wet well with a single pump. The lift station at Building 364-A had two pumps in a dry well with an adjacent wet well. One pump had been removed for service at the time of this survey. The lift station at Building 546 had one pump in a dry well with an adjacent wet well.

d. Nondomestic Wastewater Sources. Nondomestic wastewater which entered the collection system included neutralized wastes form a battery shop in Building 627, laundry wastewater, and treated industrial wastewater from the collection and treatment system in the South Plant area. The industrial wastewater collection and treatment system is discussed in the industrial wastewater section of this report.

3. Treatment.

a. General.

(1) Plant Description. The domestic WWTP consisted of a bar screen, two Imhoff Tanks, two multi-media filters, two carbon contact columns, and a chlorination system. Appendix E contains a schematic diagram of the WWTP. The bar screen and Imhoff Tanks were constructed in 1942, the lagoon was added in the 1960's, and the filters and carbon columns were installed in 1979. Average daily flows for the six-month period preceding this survey are provided in Appendix F. Emergency power was not provided for the WWTP. In the event of a power failure, the wastewater would pass through the bar screen and Imhoff Tank and then overflow from the wet well ahead of the filters into a nondischarging lagoon. The lagoon could contain at least six weeks' overflow at the average daily flow, which eliminated the need for emergency power. Wastewater in the lagoon received no additional treatment.

(2) Plant Evaluation.

(a) The WWTP was designed to treat an average daily flow of 57,600 gallons and up to a peak flow of 115,000 gallons. The limiting process was the filter system. The raw wastewater was weak, with a 5-day biochemical oxygen demand (BOD_5) of 10 to 20 milligrams per liter (mg/L), and a total suspended solids (TSS) concentration of 2 to 60 mg/L.

(b) The NPDES permit limits for BOD_5 and TSS in the WWTP effluent were 30 mg/L each. The permit also required 85 percent removal of the influent BOD_5 and TSS concentrations. The effluent consistantly met the concentration limitations, with effluent BOD_5 and TSS averaging 8 mg/L and 5 mg/L, respectively; however, 85 percent removal was not achieved. The overall plant efficiency for BOD_5 removal was 50 to 70 percent, and TSS removal efficiency was 65 to 95 percent. An effluent concentration for BOD_5 and TSS of 2 mg/L and 4 mg/L respectively, would be required to comply with the 85 percent reduction standard. RMA should negotiate with the EPA to have the 85 percent reduction requirement removed from the NPDES permit. This Agency can provide assistance in negotiating with the EPA for permit modification upon request.

(c) Chlorine residuals in the plant effluent exceeded the NPDES permit limit of 0.5 mg/L in all permit monitoring reports from June through November 1983. RMA laboratory personnel determined that the reported chlorine levels may have been falsely high due to interferences in the analytical method used. After changing to the N,N-diethyl-p-phenylenediamine plus ferrous ammonium sulfate (DPD-FAS) method, the residual chlorine results were in compliance with the permit limitations.

b. Headworks. The headworks consisted of a single, properly designed, manually cleaned bar screen. Screenings were buried in a trench at the WWTP. At the time of this survey, the bar screen chamber had 6 to 8 inches of sludge in the bottom of the channel. Sludge deposition occurred because of the low sewage flows, and resultant low velocities. This sludge needed to be removed at least weekly. The sludge could be removed directly from the bar screen chamber and disposed of, manually. Alternatively, if a water source were made available, the sludge could be flushed into the Imhoff Tanks.

c. Unit Operations.

(1) Imhoff Tanks.

(a) The WWTP had two Imhoff Tanks designed to operate in parallel. Each tank had two settling compartments. Each settling compartment had a volume of 2,400 ft^3, or 18,000 gallons, yielding 36,000 gallons of settling volume per tank. Each tank had a sludge compartment volume of approximately 9,000 ft^3. Based on standard design criteria of 2.5 hour detention time in the settling compartment at the average flow and 3 to 4.5 ft^3 per capita sludge capacity, each Imhoff Tank was sized for a flow of about 350,000 gpd and a population of about 2,500. At the time of this survey only one tank and one settling compartment were in use, which provided a detention time of 13 hours at the average flow of 33,000 gpd.

(b) The Imhoff Tanks were not properly operated or maintained, and were in a state of extreme disrepair. The settling compartments were constructed of wood boards. Many of these boards had pulled loose from the supports and floated to the surface of the tanks. The wooden catwalks over the tanks had deteriorated and were unsafe. The operator could not work from the catwalks and therefore did not clean the walls and slots of the settling compartments, clear the gas vents, measure the sludge depth, or withdraw sludge. Sludge reportedly had not been withdrawn from the Imhoff Tank in 10 years, and the sludge depth in the tank was not known. Periodic sludge withdrawal is a necessary part of proper operation. In order for the Imhoff Tank to be an effective treatment process, renovation and proper operation were required. Information on the proper operation and maintenance of Imhoff Tanks was provided to installation personnel.

(c) There were potentially two major problems with the sludge. The lower layers may have been so dense that the sludge could not be pumped, and the sludge was probably contaminated with DBCP which could make it a hazardous waste. If the sludge solidified and clogged the sludge withdrawal pipes, it would have to be mechanically removed. The sludge should be analyzed for DBCP, prior to disposal, to determine if it is a hazardous waste. The analytical laboratories at RMA had the capability to analyze for DBCP.

(2) Filters.

(a) The Imhoff Tank effluent flowed by gravity into a 10,000 gallon wetwell. The wet well was equipped with a bubbler-type aeration system to keep the contents mixed and aerobic. The wetwell was equipped with an over- flow to the previously mentioned lagoon. The wastewater overflowed to the lagoon whenever the filters were out of service or when the flow exceeded the capacity of the filtration system.

(b) Two 40 gpm submersible pumps pumped the wastewater from the wetwell to two multimedia filters operated in parallel. The pumps were controlled by dual-position float switches.

(c) The filters were Culligan® Depth Filters, Model HQ-36. Each filter was a closed pressure-vessel, multi-media system. The media consisted of Culligan proprietary materials designed to remove suspended solids and oils. The filters were 36 inches in diameter and provided approximately 7 ft^2 of filter area each. With both filters in service at the average flow of 33,000 gpd, the filter loading was 1.6 gallons per minute per square foot (gpm/ft^2). The system was designed for an average flow of 40 gpm, and a peak flow of 80 gpm. One of the filters could treat the average flow if necessary. The filters used Culligan's Quadra-Kleen® backwash system, which was a four-stage automated process. During the fluidization stage of the backwash, the flow rate was 24 gpm/ft^2 for 4 to 25 minutes. Water from the chlorine contact chamber was used for backwashing. The backwash procedure was manually initiated, based on headloss. The filters were normally backwashed every other day. The backwash effluent was discharged to the lagoon.

(3) Lagoon. The lagoon was an earthen-dike artificial impoundment, originally constructed for use as an oxidation pond. At the time of this survey it was used to contain overflow from the wet well and backwash water from the filters. The lagoon had an area of 1.3 acres and could contain 1.4 million gallons. At the time of this survey, there was very little standing water in the lagoon. Water discharged to the lagoon would either evaporate or percolate. Construction details of the lagoon were not available; therefore, it was not known how much percolation occurred. Wastewater which overflowed to the lagoon from the wet well contained DBCP as did the filter backwash water. If percolation occurred, it could contaminate the groundwater with DBCP. This situation needed to be investigated.

(4) Carbon Contact Columns. Filtered water next passed through two carbon columns, operated in series. The columns were closed steel pressure tanks, 6-feet in diameter and 8-feet tall. Each column contained approximately 5,000 lbs of granular activated carbon (GAC), with a density of about 28 lbs/ft^3. Five thousand pounds of GAC with a density of 28 lbs/ft^3 occupies a volume of approximately 180 ft^3. The GAC should have had approximately 80 percent void space in the bed, resulting in a void volume of 144 ft^3 or 1,100 gallons. The carbon columns had a surface area of 28 ft^2. At the average

flow of 33,000 gpd, the surface loading on the carbon columns was 0.82 gpm/ft^2 and the detention time in the GAC bed was 49 minutes. At the peak flow of 115,200 gpd, the surface loading was 2.9 gpm/ft^2 and the detention time was 14 minutes. Conventional design parameters for GAC columns included a surface loading of 3 to 5 gpm/ft^2, a detention time of 15 to 35 minutes, and a minimum height to diameter ratio of 2:1. The volume and detention times of the columns were within normal limits. The diameter of the columns was greater than that recommended in the standards. Although the columns did not conform to standard design criteria, they effectively removed DBCP. The carbon in the first column was considered exhausted and was replaced when the first column's effluent exceeded 0.2 micrograms per liter (μg/L) of DBCP. Normally, however, the carbon was changed more often than the above breakthrough criteria would dictate. The carbon was changed at the same time the carbon in the boundary treat-
ment systems was changed. After new carbon was placed in the exhausted column, the order in which the columns was operated was reversed.

(5) Chlorination.

(a) The chlorine contact chamber was equipped with over and under baffles and had a volume of 10,000 gallons. The detention time at the average and peak flows was 7 and 2 hours, respectively. These values were far in excess of standard design criteria. The extra volume provided sufficient water for backwashing the filters.

(b) Calcium hypochlorite tablets were used as the chlorine source. The tablets were contained in a dispenser through which the water flowed as it entered the chlorine contact chamber.

(c) The chlorine contact chamber had substantial algae growth. The presence of algae in the chlorine contact chamber could interfere with disinfection and add BOD_5 and suspended solids to the effluent. Regular cleaning of the chamber, including scrubbing the sides and baffles, would help control the algae growth.

d. Other Treatment Facilities. RMA had 14 septic-tank/leach-field systems. Five of the systems were in regular use. The other systems were either temporarily not in use or abandoned. There was no program for inspection, maintenance, or cleaning of the septic tanks.

(1) All septic tank systems in use should be inspected and cleaned at least once a year, or more often if necessary. Regular inspection and cleaning should ensure that the systems operate efficiently, and that all component parts function properly. Any septic tanks that are abandoned, disconnected, or no longer needed, should be broken up and filled. Rock or earth is suitable for filling abandoned septic tanks. Any septic tanks not in use but expected to be returned to service should be cleaned and maintained in a stand-by status.

(2) The septic tank system which served the west gate (Buildings 141-143, 149), was failing at the time of this survey. Effluent from the septic tank came to the surface and flowed over the ground. The problem was reported to utilities personnel, who corrected the situation. The failure had been caused by an obstructed distribution box in the tile field. Regular inspections and maintenance would have prevented this problem.

(3) The septic tank serving Building 373 was not operating properly. Building 373 was the only occupied quarters on RMA. The septic tank was very old, having been installed some time prior to 1942. Utilities personnel reported that the tile field had been damaged and could no longer effectively dispose of the tank effluent. The tank was periodically pumped to resolve this problem. This system should have been replaced; however, the DEH reported that the occupants of the quarters would move out within the next 9 months, and the quarters were to be closed. The expense of a new system would not be justified for such a short period. Continued pumping of the tank, when needed, should be an adequate temporary solution. If for any reason the quarters are retained, the entire septic-tank/leach-field system should be replaced.

4. Effluent Disposal. The WWTP discharged into a drainage way which was a tributary to First Creek. First Creek flowed into the O'Brian Canal, which flowed into Barr Lake. First Creek was classified by the State of Colorado as Class 2 recreation, Class 2 warm water aquatic life, and agriculture. The water quality standards for this classification were dissolved oxygen greater than or equal to 5 mg/L, pH 6.5 to 9.0, and fecal coliform bacteria 2,000 per 100 mL. The WWTP discharge was often the only flow in First Creek and it met the water quality standards for the stream. The NPDES permit effluent limitations were based on the water quality standards for First Creek, and, as discussed in paragraph VB3a(2), the WWTP was in compliance with the permit. During dry weather, much of the WWTP effluent percolated into the ground downstream from the discharge point.

5. Monitoring.

a. <u>Operational</u>. The only operational monitoring performed consisted of daily recording of filter headloss readings and analyzing the first carbon column effluent monthly for DBCP. When the Imhoff Tanks are renovated, the additional monitoring requirements discussed in para V3c(1)(b) should be implemented.

b. <u>Compliance Monitoring</u>. Appendix D contains the NPDES monitoring requirements for the WWTP. Samples were collected by personnel from the Technical Operations Division and analyses were performed by the RMA Analytical Services Branch. The required results were reported to the EPA and the DEH.

6. Personnel. Responsibility for the operation of the WWTP was split between the Buildings, Grounds, and Utilities (BGU) Branch and the Technical Operations Division.

a. The operator from the BGU Branch of the DEH was responsible for operating the lift stations, headworks, and Imhoff Tanks.

(1) The operator had been at RMA for 14 months, and had 4 years of prior experience with wastewater treatment. The operator was pursuing State certification.

(2) The WWTP operator did not follow proper safety practices in inspection and maintenance of the lift stations. The operator inspected the lift stations daily, normally working alone. Entrance to the lift stations was by vertical ladders. Proper safety practices when working in confined areas, such as lift stations, should include the use of proper personal protective equipment; ventilation of the area before entry and while working; atmospheric testing for toxics, oxygen deficiency, and explosive mixtures; personnel training for working in confined areas; retrieval devices in case of accident or injury; and use of a buddy system for workers, when necessary. The WWTP operator and the Chief of BGU should coordinate with the RMA Safety Office for assistance in determining what safety measures are necessary for the operations at RMA, and implement proper practices. Additional guidance on proper safety practices can be found in Chapter 17, TM 5-665. A copy of TM 5-665 was furnished to the Chief, BGU.

b. The filtration and carbon adsorption system was operated by personnel from the Technical Operations Division. The chief operator had worked with the system since its installation, and had prior experience with similar systems. The filtration and carbon adsorption systems were operated properly.

C. <u>Industrial Wastewater</u>.

1. General. The major industrial wastestreams consisted of air compressor cooling water in the North Plant area, laboratory wastes in the South Plant area, wastes from the hydrazine fuel blending facility, vehicle washrack wastes, blowdown from the main steam plant, and the filter backwash water from the swimming pool.

2. Air Compressor Cooling Water. Air compressors located in Building 1704 used once-through, noncontact cooling water. This cooling water was discharged to a tributary of First Creek. The discharge was permitted under the same NPDES permit as the domestic WWTP discharge. The discharge was intermittent and considered to be of little environmental significance by the EPA. The permit limited the discharge to once-through, noncontact cooling water, and no chemicals could be added. The permit required that the discharge be visually examined at least monthly for a sheen and floating oil, that necessary corrective measures be taken if oil were found, and that the approximate discharge rate be determined at least once per year. RMA was not required to report these monitoring results to the EPA, but they were to be recorded and maintained on file for inspection. RMA had not been performing this self-monitoring. The installation needed to perform the required monitoring and maintain records of the results.

3. South Plant Laboratory Wastes. Nondomestic wastewater from the analytical laboratories in Buildings 313 and 743 and the pesticide shop in Building 742 was collected and treated at Building 540 and discharged to the sanitary sewer.

a. Collection. The wastewater was collected in 3- to 6-inch diameter force mains. Two lift stations pumped the wastewater to the treatment facility in Building 540. The lift stations each consisted of one aboveground pump with a wet well. The pumping capacities were not known. Lift station 743-A served Buildings 742 and 743. Lift station 313-A served Building 313. The wastes were collected in a 170,000 gallon aboveground steel storage tank.

b. Treatment. The treatment system consisted of cartridge filters, a carbon column, and an activated alumina column. The system was designed to remove suspended solids, organic compounds, and arsenic and operated at 1 to 2 gpm (1,440-2,880 gpd) based on 18 feet of head in the 170,000 gallon tank. The two parallel filters used disposable 10-micron filter cartridges. The carbon column consisted of a 6-foot high, 18-inch diameter section of polyvinyl chloride (PVC) pipe containing approximately 9 ft^3 of GAC. At 2 gpm, the loading on the carbon column was approximately 1 gpm/ft^2, and the detention time in the GAC was 27 minutes. These values were within the normal design standards range. The activated alumina column was a 6-foot high, 6-inch diameter section of PVC pipe, and contained approximately 1 ft^3 of activated alumina. The activated alumina column was installed to remove arsenic. The system should have effectively removed arsenic, but since no analyses were performed for arsenic, its performance could not be evaluated.

c. Monitoring and Disposal. Influent and effluent samples were collected once per month and analyzed for TSS, pH, and organics. The treated effluent was discharged to the sanitary sewer. RMA received approval from the EPA to discharge to the sanitary system in 1982. The EPA approved the discharge based on the treatment process, but did not establish any pre-treatment requirements or effluent limitations. The system had been in operation since 1982 and no problems were reported.

4. Hydrazine Facility Wastes. The Department of the Air Force operated a hydrazine final blending facility at RMA. All wastewater from this operation was collected and stored in two holding tanks which had a combined capacity of 250,000 gallons. The Air Force was responsible for the treatment and disposal of the wastes, which was accomplished offsite.

5. Vehicle Washrack. The only vehicle washrack at RMA was located in Building 627. The discharge from the washrack contained detergent and a water-soluble degreaser. The washrack discharged untreated wastewater to an open trench behind Building 627. The trench was closed at both ends, which prevented the discharge from reaching surface waters. The discharge percolated into the ground. The washrack discharge may have been in violation of Colorado

Water Quality Control Regulations. This situation was discussed with the Compliance Engineer for Colorado from EPA, Region VIII. She stated that the EPA would investigate the situation and determine if there was a violation.

6. Boiler Blowdown. Blowdown from the main boilers, located in Building 321, was discharged to drainage ditches. These ditches drained to Lower Derby Lake. This lake was a nondischarging artificial reservoir used for process water storage. Because the blowdown flowed to the process water reservoir no permit was required for this discharge.

7. Swimming Pool Filter Backwash. The backwash water from the swimming pool, Building 368, also discharged to the process water reservoirs, and no permit was required.

D. Surface/Stormwater Drainage. RMA was in the drainage basin of the South Platte River. First Creek, an intermittent stream, flowed thorough the eastern part of the installation. The only other surface water bodies on the installation were several man-made impoundments. Average surface runoff for the area was one inch per year. Storm drainage was collected in a series of ditches and culverts which discharged to either the process water reservoirs or to First Creek. Permits were not required for the surface/storm drainage discharges.

E. Laboratories. As a result of previous and ongoing activities, RMA had developed extensive laboratory capabilities. The personnel were well trained and the facilities were well equipped. The laboratories had the capability to perform a wide range of analyses. All operational and compliance monitoring was conducted in RMA's laboratories, and all results were accepted by EPA, Region VIII. The only problem observed was that the water distillation unit in Building 313 did not consistently produce water of adequate quality. This unit needed to be replaced.

F. Oil and Hazardous Substances Spill Control and Contingency Plans.

1. A draft of RMA's Spill Prevention, Control, and Countermeasures Plan (SPCCP) and Installation Spill Contingency Plan (ISCP) was reviewed during this survey. The plans were inadequate. Examples of some of the inadequacies follow.

2. The SPCCP identified several aboveground oil stroage tanks that had unlined earth berms, and stated that these berms provided total containment of the tanks' contents. For aboveground oil storage tanks, the following requirement [40 CFR 112.7(e)(2)(ii)] must be met: "All bulk storage tank installations should be constructed so that a secondary means of containment is provided for the entire contents of the largest single tank plus sufficient freeboard to allow for precipitation. Diked areas should be sufficiently impervious to contain spilled oil. Dikes, containment curbs, and pits are commonly employed for this purpose, but they may not always be appropriate. An alternative

system could consist of a complete drainage trench enclosure arranged so that a spill could terminate and be safely confined in an in-plant catchment basin or holding pond." Catchment basins should not be located in areas subject to periodic flooding. Earth berms are generally not sufficiently impervious to contain spilled oil. Oil tanks with earth berms were: Tank 1510 (Fuel Oil), Tanks 626 A-D and Tank 628A (Diesel), Tanks 321A, B, and E (Fuel Oil), a MOGAS mobile fuel station in the South Plant area, and Tanks 745 A, B, and C (Diesel).

3. The SPCCP inaccurately described some containment structures. These inadequacies are discussed below.

a. Tank 1510 was described as contained by an earth berm 4.5 feet high with a capacity of 202,000 gallons. The tank has a capacity of 200,000 gallons. The berm had deteriorated, and was actually less than 2 feet high.

b. Tank farm 1403 was contained in part by concrete sumps. The SPCCP failed to note that some of the sumps were equipped with drains that led to the chemical waste collection system for the North Plant area. The SPCCP also failed to address what would happen if a spill drained to the chemical waste collection system.

4. The SPCCP did not include some storage facilities. The 170,000 gallon chemical waste collection tank in the South Plant area was not addressed. None of the storage facilities in the Shell Chemical Company lease area were addressed. RMA personnel may have to respond to a spill at these sites; therefore, these facilities should be addressed in the SPCCP.

5. The ISCP did not adequately detail response procedures. The ISCP should outline site-specific spill response procedures to include:

a. An estimate of the manpower, equipment, vehicles, supplies, and material resources required to expeditiously contain, recover, and remove the maximum harmful quantity of oil or hazardous substance discharged.

b. An established, prearranged procedure for requesting resources from other DOD Installations or private contractors, if necessary.

6. The SPCC and ISC plans needed to be revised to make them more accurate and more complete. This Agency can provide assistance in spill plan preparation upon request.

VI. CONCLUSIONS.

A. The Imhoff Tank at the WWTP was in a poor state of repair, improperly operated and maintained, and required major renovation.

B. The lagoon at the WWTP was a potential source of groundwater contamination.

C. The SPCCP and ISCP were inaccurate and incomplete.

VII. RECOMMENDATIONS. The basis for each recommendation is identified in each subparagraph.

A. Negotiate with EPA Region VIII to have the NPDES Permit requirement for 85 percent reduction of biochemical oxygen demand and total suspended solids deleted from the NPDES permit. (This recommendation is based on good engineering practice)

B. Remove the settled sludge from the bar screen chamber of the wastewater treatment plant weekly. (This recommendation is based on good engineering practice)

C. Renovate the Imhoff Tanks and implement proper operating and monitoring procedures. (This recommendation is based on good engineering practice)

D. Analyze the Imhoff Tank sludge for DBCP prior to its removal and disposal [refer to para VB3c(1)(c)]. (This recommendation is based on good engineering practice)

E. Determine if DBCP in the lagoon at the wastewater treatment plant is a source of groundwater contamination. (This recommendation is based on good engineering practice)

F. Clean the chlorine contact chamber regularly to control algae growth. (This recommendation is based on good engineering practice)

G. Inspect and clean all septic-tank/leach-field systems in use at least once a year. (This recommendation is based on good engineering practice)

H. Fill all abandoned septic tanks with dirt or rock material. (This recommendation is based on good engineering practice)

I. Clean and maintain septic tanks that may be returned to service. (This recommendation is based on good engineering practice)

J. Institute, in coordination with the RMA Safety Office, proper safety practices for sanitation personnel inspecting lift stations. (Chapter 17, TM 5-665)

K. Perform the monitoring required by the NPDES permit for the air compressor cooling water discharge at Building 1704. (NPDES Permit No. CO-0021202)

L. Replace the water distillation unit in Building 313. (This recommendation is based on good engineering practice)

M. Revise the Spill Prevention, Control, and Countermeasures Plan and the Installation Spill Contingency Plan to ensure accuracy and completeness. (Para 8-6 and 8-9, AR 200-1 and good engineering practice)

VIII. TECHNICAL ASSISTANCE. Requests for services should be directed through appropriate command channels of the requesting activity to the Commander, US Army Environmental Hygiene Agency, ATTN: HSHB-EW, Aberdeen Proving Ground, Maryland 21010, with an information copy furnished the Commander, US Army Health Services Command, ATTN: HSCL-P, Fort Sam Houston, Texas 78234.

Michael F. LaDuc

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Steven C Richards, CPT, MSC
FOR JAMES J. EVENDEN
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Chief, Environmental Health
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APPENDIX A
REFERENCES

1. Public Law 92-500, Federal Water Pollution Control Act, 18 October 1972, as amended by Public Law 95-217, Clean Water Act, 28 December 1977.

2. Title 33, Code of Federal Regulations (CFR), 1983, rev, Part 153, Control of Pollution by Oil and Hazardous Substances, Discharge Removal.

3. Title 40, CFR, 1983 rev, Part 109, Criteria for State, Local, and Regional Oil Removal Contingency Plans.

4. Title 40, CFR 110, 1983 rev, Part 110, Discharge of Oil.

5. Title 40, CFR, 1983 rev, Part 112, Oil Pollution Prevention.

6. Title 40, CFR, 1983 rev, Part 116, Designation of Hazardous Substances.

7. Title 40, CFR, 1983 rev, Part 117, Determination of Reportable Quantities for Hazardous Substances.

8. AR 40-5, Health and Environment, 25 September 1974.

9. AR 200-1, Environmental Protection and Enhancement, 15 June 1982.

10. AR 420-15, Certification of Utility Plan Operators and Personnel Performing Inspection and Testing of Verticle Lift Devices, 5 June 1982.

11. AR 420-46, Water and Sewage, 1 July 1978.

12. TM 5-665, Operation and Maintenance of Domestic and Industrial Wastewater Systems, January 1982.

13. TM 5-666, Inspections and Preventive Maintenance Services, Sewage Treatment Plants and Sewer Systems at Fixed Installations, 29 September 1945.

14. TM 5-814-1, Sanitary and Industrial Waste Pumping Stations, August 1965.

15. TM 5-814-3, Domestic Wastewater Treatment, 17 November 1978.

16. TM 5-814-3, Industrial Wastes, October 1965.

APPENDIX B
PERSONNEL CONTACTED

	BRIEFINGS ENTRANCE	BRIEFINGS EXIT
1. Rocky Mountain Arsenal		
a. Mr. David Heim, Director of Installation Services, AUTOVON 556-0115.		X
b. Mr. James Green, Director of Engineering and Housing, AUTOVON 556-0116.	X	X
c. Mr. Garland Gunther, Chief, Engineering Plans and and Services, AUTOVON 556-0167.		X
d. Mr. Darrel Mack, Chief, Buildings, Grounds and Utilities, AUTOVON 556-0412.	X	X
e. Mr. Elijah Jones, Laboratory Supervisor, AUTOVON 556-0226.	X	X
f. Mr. Roger Corman, General Counsel, AUTOVON 556-0147.		X
2. Stearns-Roger Inc.		
a. Mr. Cecil Acree, Project Manager, AUTOVON 556-0244.	X	
b. Mr. Ken Keller, Assistant Operations Supervisor, AUTOVON 556-0258.	X	
3. Ms. Nina Churchman, USEPA Region VIII, Colorado Compliance Engineer, Commercial (303) 837-4335.		

SUBJECT: Wastewater Engineering Survey No. 32-66-0108-84, Rocky Mountain Arsenal, Commerce City, Col .do, 15-29 February 1984

APPENDIX C

GENERAL SITE MAP

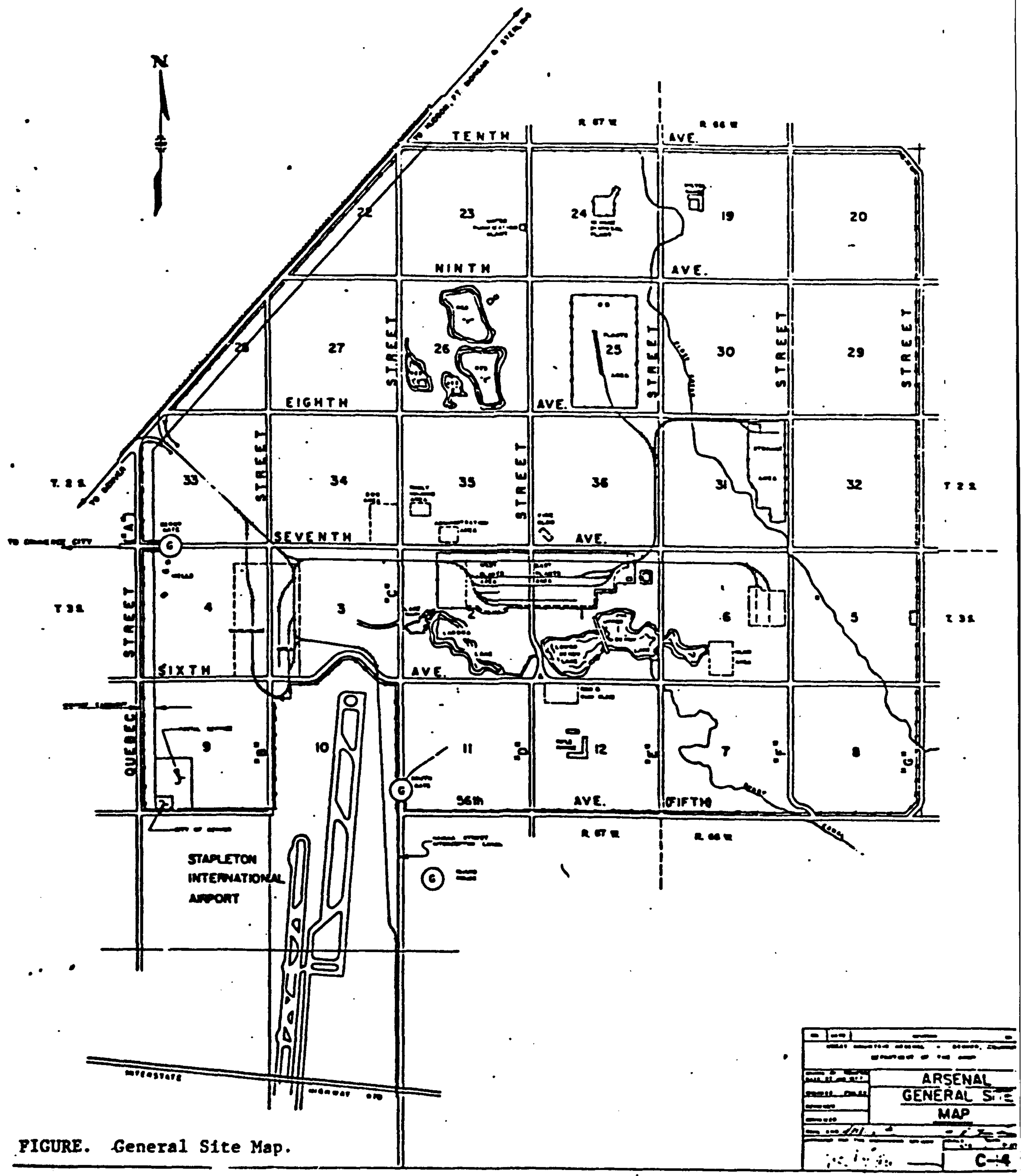

FIGURE. General Site Map.

HSHB-MW-E
SUBJECT: Wastewater Engineering Survey No. 32-66-0108-84, Rocky Mountain Arsenal, Commerce City, Colorado, 15-29 February 1984

APPENDIX D

NPDES MONITORING REQUIREMENTS AND EFFLUENT LIMITATIONS

Percentage Removal Requirements: 85 percent reduction of Influent BOD_5 and Total Suspended Solids

Outfall Serial No. 002:

Effluent Limitations - Outfall Serial No. 002:

Effective immediately and lasting through June 30, 1986, the quality of effluent discharged shall, as a minimum, meet the limitations as set forth below:

The discharge shall consist exclusively of once-through, noncontact cooling water from the cooling of air compressors. No chemicals shall be added to the water due to process operations.

Self-Monitoring Requirements - Outfall Serial No. 002:

The approximate rate of discharge shall be determined at least once per year. The flow rate may be determined by use of a flume, weir, pump discharge curves, or other appropriate methods.

The discharge shall be visually examined monthly for the presence of an oil sheen and/or floating oil. If a sheen and/or floating oil are observed, the necessary corrective measures shall be taken as soon as practical.

The self-monitoring results shall not be reported on a Discharge Monitoring Report Form, but instead shall be recorded and made available for inspection upon request by the EPA and/or the State of Colorado, Water Quality Control Division.

* - Extracted from "Major Federal Facility Permit Renewal and Consolidation," Permit Number CO-0021202, Rocky Mountain Arsenal, Denver, Colorado.

APPENDIX D
NPDES MONITORING REQUIREMENTS AND EFFLUENT LIMITATIONS

OUTFALL SERIAL NO. 001. Domestic Wastewater Treatment Plant

PARAMETER*	EFFLUENT LIMITATIONS 30 CONSECUTIVE DAY PERIOD	7 CONSECUTIVE DAY PERIOD	FREQUENCY	SAMPLE TYPE
BOD_5	30	45	Monthly	Composite
Total Suspended Solids	30	45	Monthly	Composite
Fecal Coliform Bacteria (colonies/100 mL)	2,000	4,000	Monthly	Composite
Total Residual Chlorine	Max 0.5		Weekly	Grab
pH (units)	Remain between 6.0 and 9.0		Weekly	Grab
DBCP(μg/L)	Not exceed 0.2 in three consecutive grab samples		Weekly	Grab
Oil and Grease	Not exceed 10 in any grab sample nor shall there be a visible sheen		Weekly	Grab
Total Flow, MGD	-	-	Continuous	Water Meter
Chloroform	-	-	Quarterly	
Carbon Tetrachloride	-	-	Quarterly	Grab or Composite
Trichloroethane	-	-	Quarterly	"
Tetrachloroethene	-	-	Quarterly	"
p-chlorophenyl methyl-sulfide	-	-	Quarterly	"
p-chlorophenyl methyl-sulfoxide	-	-	Quarterly	"
p-chlorophenyl methyl-sulfane	-	-	Quarterly	"
n-nitrosodimethylamine	-	-	Quarterly	"

* - All units are mg/L unless otherwise indicated.

APPENDIX E

GRAPHICAL ILLUSTRATION

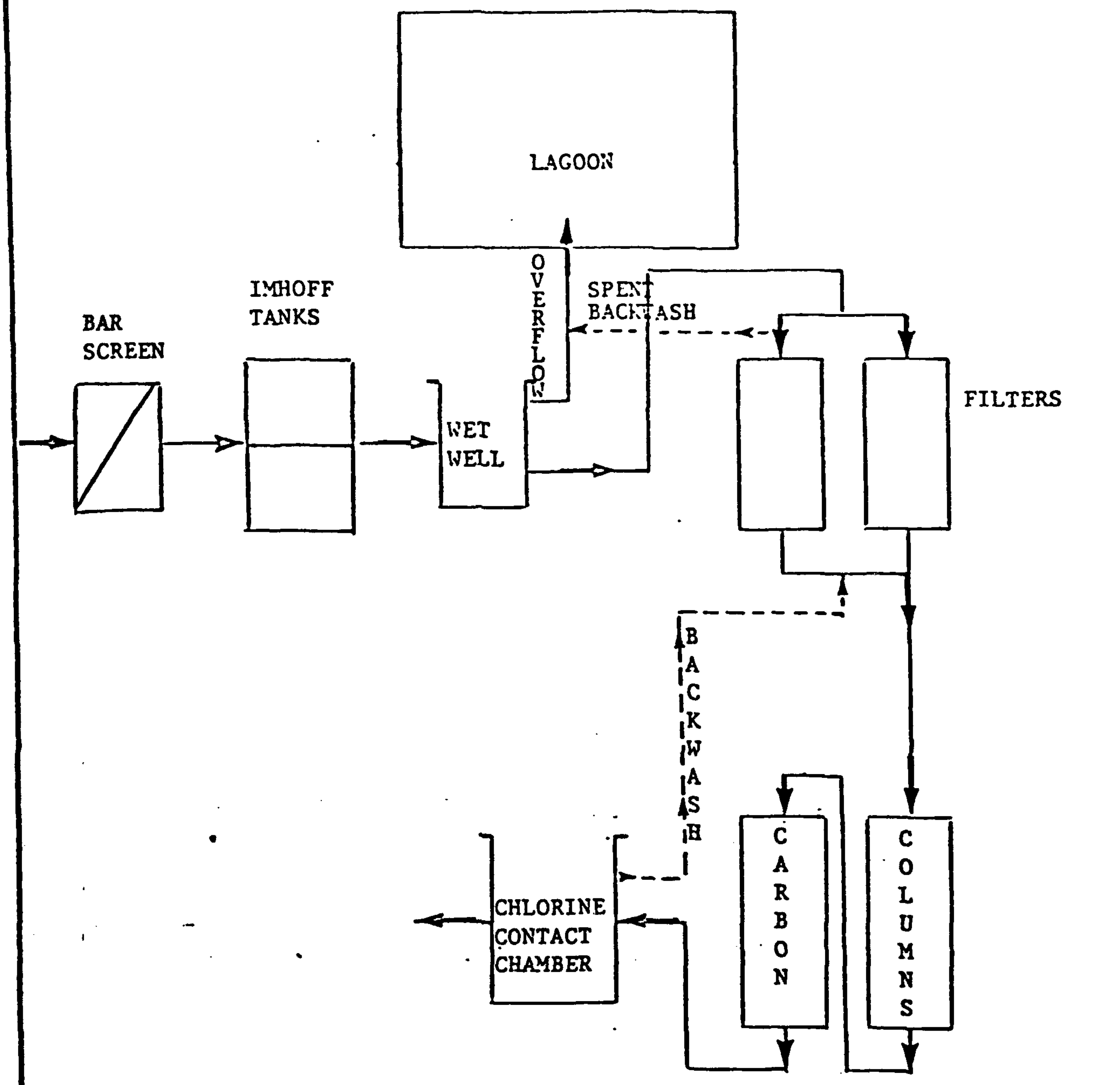

FIGURE. DOMESTIC WASTEWATER TREATMENT PLANT SCHEMATIC, ROCKY MOUNTAIN ARSENAL, COLORADO

U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY

UNITED STATES ARMY MEDICAL DEPARTMENT

DATE 4 Apr 84
DRAWN JCW
APPROVED MFL
SCALE NONE
PLATE -

USAEHA Form 15, 12 Aug 74 (HSE-AT)

HSHB-MW-E
SUBJECT: Wastewater Engineering Survey No. 32-66-0108-84, Rocky Mountain Arsenal, Commerce City, Colorado, 15-29 February 1984

APPENDIX F
HISTORICAL WASTEWATER FLOW DATA

TABLE. AVERAGE DAILY WASTEWATER FLOW.

MONTH 1983	FLOW (gallons/day)
July	59,829
August	33,428
September	25,999
October	23,276
November	27,214
December	27,300